WHAT IS CLAIMED IS:

1. A scanning optical apparatus comprising:

light source means;

a deflecting element for deflecting a beam of light emitted from said light source means;

optical means for causing the beam of light emitted from said light source means to be imaged into a linear shape long in the main scanning direction on the deflecting surface of said deflecting element, said optical means being comprised of a first optical element and a second optical element; and

a third optical element for causing the beam of light deflected by said deflecting element to be imaged into a spot-like shape on a surface to be scanned, said third optical element comprising a single lens, the opposite lens surfaces of which both comprise a toric surface of an aspherical surface shape in the main scanning plane, the curvatures of said opposite lens surfaces in the sub scanning plane being continuously varied from the on-axis toward the off-axis in the effective portion of the lens.

2. A scanning optical apparatus according to Claim 1, wherein said light source means has a plurality of light source units capable of being independently modulated.

3. A scanning optical apparatus according to Claim 1, wherein when the curve amounts of the loci, in the main scanning plane, of the front side principal plane and the rear side principal plane of said third optical element in the sub scanning direction (the difference in the direction of the optical axis between the most off-axis principal plane position and the on-axis principal plane position) are xm and xu, respectively, the following condition is satisfied:

$$xm \leq dx \leq xu,$$

where

$$dx = \frac{Ipri \cdot Epri(\cos\theta img - \cos\theta por)}{Ipri \cdot \cos\theta por + Epri \cdot \cos\theta img}$$

Ipri is the distance from the deflecting surface of the deflecting element in the on-axis beam to the front side principal plane in the sub scanning direction;

Epri is the distance from the rear side principal plane in the sub scanning direction in the on-axis beam to the surface to be scanned;

θpor is the angle formed in the main scanning plane by the most off-axis beam deflected by the deflecting element with respect to the optical axis;

θimg is the angle formed in the main scanning plane by the most off-axis beam incident on the surface to be scanned with respect

to the optical axis.

4. A scanning optical apparatus according to Claim 1, wherein the sign of the curvature of at least one of the opposite lens surfaces of the single lens constituting said third optical element in the sub scanning plane is reversed from the on-axis toward the off-axis.

5. A scanning optical apparatus according to Claim 1, wherein said third optical element is made by plastic molding.

6. A scanning optical apparatus according to Claim 1, wherein said third optical element is made by glass molding.

7. A scanning optical apparatus comprising:

light source means;

a deflecting element for deflecting a beam of light emitted from said light source means;

optical means for causing the beam of light emitted from said light source means to be imaged into a linear shape long in the main scanning direction on the deflecting surface of said deflecting element; and

an optical element for causing the beam of light deflected by said deflecting element to be imaged into

a spot-like shape on a surface to be scanned, said optical element comprising a single lens, the opposite lens surfaces of which both comprise a toric surface of an aspherical surface shape in the main scanning plane, the curvatures of said opposite lens surfaces in the sub scanning plane being continuously varied from the on-axis toward the off-axis in the effective portion of the lens.

8. A scanning optical apparatus according to Claim 7, wherein said light source means has a plurality of light source units capable of being independently modulated.

9. A scanning optical apparatus according to Claim 7, wherein when the curve amounts of the loci, in the main scanning plane, of the front side principal plane and the rear side principal plane of said optical element in the sub scanning direction (the difference in the direction of the optical axis between the most off-axis principal plane position and the on-axis principal plane position) are xm and xu, respectively, the following condition is satisfied:

$$xm \leq dx \leq xu,$$

where

$$dx=\frac{Ipri\cdot Epri(\cos\theta img-\cos\theta por)}{Ipri\cdot\cos\theta por+Epri\cdot\cos\theta img}$$

Ipri is the distance from the deflecting surface of the deflecting element in the on-axis beam to the front side principal plane in the sub scanning direction;

Epri is the distance from the rear side principal plane in the sub scanning direction in the on-axis beam to the surface to be scanned;

θpor is the angle formed in the main scanning plane by the most off-axis beam deflected by the deflecting element with respect to the optical axis;

θimg is the angle formed in the main scanning plane by the most off-axis beam incident on the surface to be scanned with respect to the optical axis.

10. A scanning optical apparatus according to Claim 7, wherein the sign of the curvature of at least one of the opposite lens surfaces of the single lens constituting said optical element in the sub scanning plane is reversed from the on-axis toward the off-axis.

11. A scanning optical apparatus according to Claim 7, wherein said optical element is made by

plastic molding.

12. A scanning optical apparatus according to Claim 7, wherein said third optical element is made by glass molding.

13. A scanning optical apparatus comprising:

light source means having a plurality of light source units capable of being independently modulated;

a deflecting element for deflecting a plurality of independently modulated beams of light emitted from said light source means;

optical means for causing the plurality of independently modulated beams of light emitted from said light source means to be imaged into a linear shape long in the main scanning plane on the deflecting surface of said deflecting element, said optical means being comprised of a first optical element and a second optical element; and

a third optical element for causing the plurality of beams of light deflected by said deflecting element to be imaged into a spot-like shape on a surface to be scanned, said third optical element comprising a single lens, the curvatures of the opposite lens surfaces of said single lens in the sub scanning direction being continuously varied from the on-axis toward the off-axis in the effective portion of the lens.

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~~14.~~ A scanning optical apparatus according to Claim 1 ~~13~~, wherein when the maximum value and minimum value of the F number of the beam of light incident on the surface to be scanned in the sub scanning direction are Fmax and Fmin, respectively, the curvatures of the opposite lens surfaces of the single lens constituting said third optical element in the sub scanning direction are continuously varied from the on-axis toward the off-axis so as to satisfy the condition that

$$Fmin/Fmax \geq 0.9.$$

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~~15.~~ A scanning optical apparatus according to Claim 1 ~~13~~, wherein the sign of the curvature of at least one of the opposite lens surfaces of the single lens constituting said third optical element in the sub scanning direction is reversed from the on-axis toward the off-axis.

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~~16.~~ A scanning optical apparatus according to Claim 1 ~~13~~, wherein the curvatures of the opposite lens surfaces of the single lens constituting said third optical element in the sub scanning direction are varied asymmetrically with respect to the optical axis from the on-axis toward the off-axis.

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~~17.~~ A scanning optical apparatus according to Claim 1 ~~13~~, wherein said third optical element is made by

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plastic molding.

18. A scanning optical apparatus according to Claim 17, wherein said third optical element is made by glass molding.

19. A scanning optical apparatus comprising:

light source means having a plurality of light source units capable of being independently modulated;

a deflecting element for deflecting a plurality of independently modulated beams of light emitted from said light source means;

optical means for causing the plurality of independently modulated beams of light emitted from said light source means to be imaged into a linear shape long in the main scanning direction on the deflecting surface of said deflecting element; and

an optical element for causing the plurality of beams of light deflected by said deflecting element to be imaged into a spot-like shape on a surface to be scanned, said optical element comprising a single lens, the curvatures of the opposite lens surfaces of said single lens in the sub scanning direction being continuously varied from the on-axis toward the off-axis in the effective portion of the lens.

20. A scanning optical apparatus according to

Claim 19, wherein when the maximum value and minimum value of the F number of the beam of light incident on said surface to be scanned in the sub scanning direction are Fmax and Fmin, respectively, the curvatures of the opposite lens surfaces of the single lens constituting said optical element in the sub scanning direction are continuously varied from the on-axis toward the off-axis so as to satisfy the condition that

$$Fmin/Fmax \geq 0.9.$$

21. A scanning optical apparatus according to Claim 19, wherein the sign of the curvature of at least one of the opposite lens surfaces of the single lens constituting said optical element in the sub scanning direction is reversed from the on-axis toward the off-axis.

22. A scanning optical apparatus according to Claim 19, wherein the curvatures of the opposite lens surfaces of the single lens constituting said optical element in the sub scanning direction are varied asymmetrically with respect to the optical axis from the on-axis toward the off-axis.

23. A scanning optical apparatus according to Claim 19, wherein said optical element is made by

plastic molding.

24. A scanning optical apparatus according to Claim 19, wherein said optical element is made by glass molding.

25. A scanning optical apparatus comprising:

light source means having a plurality of light source units capable of being independently modulated;

a deflecting element for deflecting a plurality of independently modulated beams of light emitted from said light source means;

optical means for causing the plurality of independently modulated beams of light emitted from said light source means to be imaged into a linear shape long in the main scanning direction on the deflecting surface of said deflecting element, said optical means being comprised of a first optical element and a second optical element; and

a third optical element for causing the plurality of beams of light deflected by said deflecting element to be imaged into a spot-like shape on a surface to be scanned, said third optical element being comprised of at least two lenses, the curvatures of at least two lens surfaces of said two lenses in the sub scanning direction being continuously varied from the on-axis toward the off-axis in the effective portion of the

lens.

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26. A scanning optical apparatus according to Claim 13, wherein when the maximum value and minimum value of the F number of the beam of light incident on said surface to be scanned in the sub scanning direction are Fmax and Fmin, respectively, the curvatures of at least two lens surfaces of the two lenses constituting said third optical element in the sub scanning direction are continuously varied from the on-axis toward the off-axis so as to satisfy the condition that

$$Fmin/Fmax \geq 0.9.$$

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27. A scanning optical apparatus according to Claim 13, wherein the sign of the curvature of at least one lens surface of said two lenses constituting said third optical element in the sub scanning direction is reversed from the on-axis toward the off-axis.

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28. A scanning optical apparatus according to Claim 13, wherein the curvatures of at least two lens surfaces of the two lenses constituting said third optical element in the sub scanning direction are varied asymmetrically with respect to the optical axis from the on-axis toward the off-axis.

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29. A scanning optical apparatus according to Claim 25, wherein at least one of the two lenses constituting said third optical element is made by plastic molding.

30. A scanning optical apparatus according to Claim 25, wherein at least one of the two lenses constituting said third optical element is made by glass molding.

31. A scanning optical apparatus comprising:

light source means having a plurality of light source units capable of being independently modulated;

a deflecting element for deflecting a plurality of independently modulated beams of light emitted from said light source means;

optical means for causing the plurality of independently modulated beams of light emitted from said light source means to be imaged into a linear shape long in the main scanning direction on the deflecting surface of said deflecting element; and

an optical element for causing the plurality of beams of light deflected by said deflecting element to be imaged into a spot-like shape on a surface to be scanned, said optical element being comprised of at least two lenses, the curvatures of at least two lens surfaces of said two lenses in the sub scanning

direction being continuously varied from the on-axis toward the off-axis in the effective portion of the lens.

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32. A scanning optical apparatus according to Claim 19, wherein when the maximum value and minimum value of the F number of the beam of light incident on said surface to be examined in the sub scanning direction are Fmax and Fmin, respectively, the curvatures of at least two lens surfaces of the two lenses constituting said optical element in the sub scanning direction are continuously varied from the on-axis toward the off-axis so as to satisfy the condition that

$$Fmin/Fmax \geq 0.9.$$

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33. A scanning optical apparatus according to Claim 19, wherein the sign of the curvature of at least one lens surface of the two lenses constituting said optical element in the sub scanning direction is reversed from the on-axis toward the off-axis.

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34. A scanning optical apparatus according to Claim 19, wherein the curvatures of at least two lens surfaces of the two lenses constituting said optical element in the sub scanning direction are varied asymmetrically with respect to the optical axis from

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the on-axis toward the off-axis.

23 35. A scanning optical apparatus according to Claim 19, wherein at least one of the two lenses constituting said optical element is made by plastic molding.

24 36. A scanning optical apparatus according to Claim 19, wherein at least one of the two lenses constituting said optical element is made by glass molding.

add A'

add D1

add F1

add G1